Ecosystems and Their Interactions

- ***Biotic*** =
  - Factors in the environment that are living

- ***Abiotic*** =
  - Chemical and physical factors of the environment (nonliving)

BIOTIC RELATIONSHIPS

SYMBIOTIC RELATIONSHIPS

- ***Symbiosis*** =
  - Situation in which two different species live together in close association

  - Types
    - Parasitism
    - Mutualism
    - Commensalism

- ***Parasitism*** =
  - One organism gets nutrients by taking them from another organism
  - One organism benefits and the other is harmed
  - Typically do not kill their hosts
    - Unlike predators
    - The host provides a home and nutrients
  - Examples
    - Viruses, many bacteria, tapeworm, leeches, mistletoe

PARASITISM

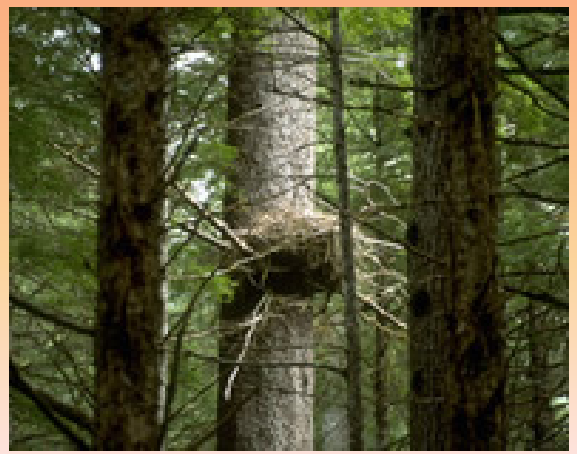
- ***Mutualism*** =
  - Relationship in which both species benefit from each other
  - Examples
    - Clownfish and anemones
    - Flowers and bees (pollination)

MUTUALISM


Alfred B. Maclay Gardens State Park
FloridaStateParks.org
Photo by Mark Ferrulo

- ***Commensalism*** =
  - One species benefits and the other is neither helped nor harmed
  - Examples
    - Decorator crabs
    - Remora and shark
    - Birds and nest in tree

COMMENSALISM



Type of Symbiosis	A	B
PARASITISM	+	-
MUTUALISM	+	+
COMMENSALISM	+	0

COMPETITIVE RELATIONSHIPS

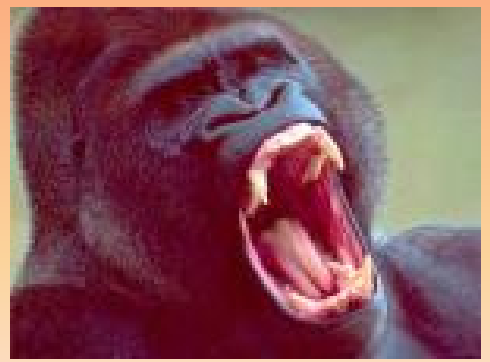
- ***Competition*** =
  - Any interaction that is harmful to both organisms

- 3 Alternatives
  - Adapt
  - Migrate
  - Go extinct

- ***Intraspecific competition*** =
  - Competition between members of the SAME species

  - ***Territoriality*** =
    - Behavioral characteristic to mark and defend a territory against other members of the same species

    - Defenses
      - Vocal
      - Scent
      - Visual displays
      - Attacks



- ***Interspecific competition*** =
  - Competition between members of DIFFERENT species

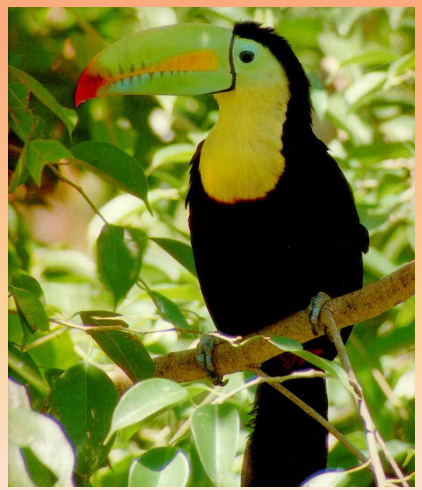
- 2 species with IDENTICAL ecological requirements cannot occupy the same environment

- Species diversity provides ecosystem stability!

Cardinals eat sunflower seeds

Woodpeckers eat insects in trees

House sparrows eat seeds and insects



Toucans eat fruit

Cassowary- Eats fruit off of ground

Eagles eat meat

Ducks strain insects

Kiwi digs for worms
(Uses smell)

Loons dive for fish

SOME ABIOTIC FACTORS

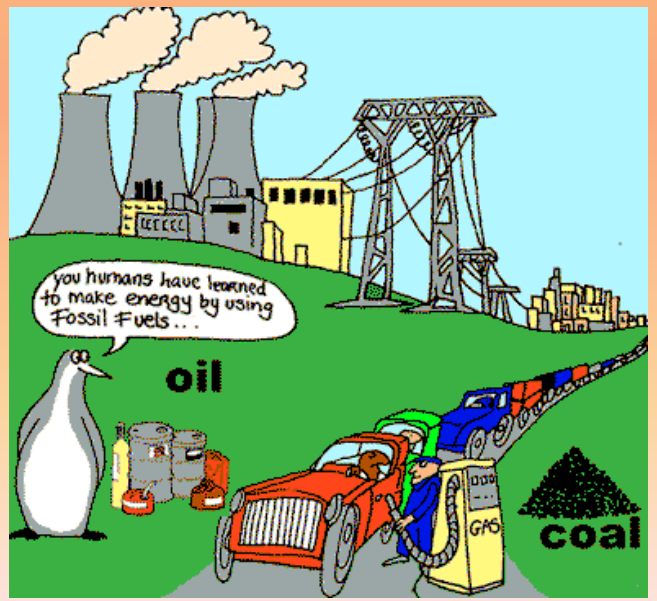
NUTRIENT CYCLING

- Why is nutrient cycling important?

1. It prevents build up of wastes
2. Guarantees that ecosystem will not run out of important elements

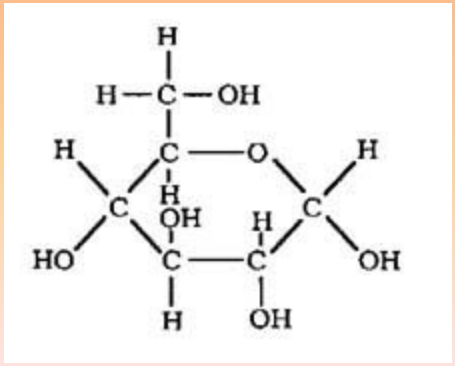
CARBON CYCLE

- In ancient geological times (hundreds of millions of years ago)
  - Organic matter built up and was buried, heated, and pressurized
  - Fossil fuels result
    - Crude oil
    - Natural gas
    - Coal



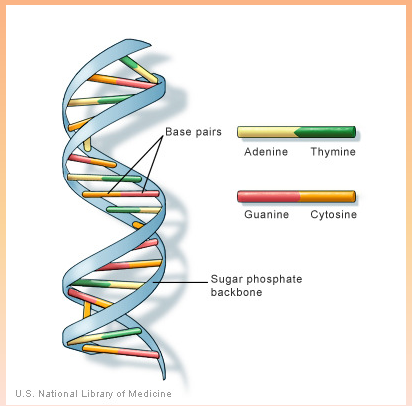
CARBON CYCLE

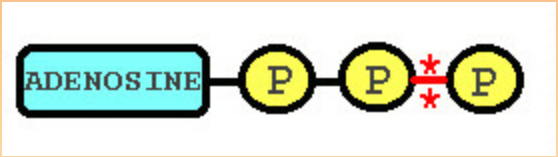
1. Plants take in CO_2 from atmosphere
2. Photosynthesis converts CO_2 to sugar (glucose)
3. Animals eat the plants
4. Animals and plants release CO_2 in respiration



PHOSPHORUS CYCLE

- Phosphorus
  - Important in structure of genes and transfer of energy
  - Exists in rocks, soil, fertilizers
  - **No gas phase**





PHOSPORUS CYCLE

1. Plants absorb phosphorus from soil
2. Bonded into organic compounds
3. Passed through food webs
4. Released in urine or similar waste

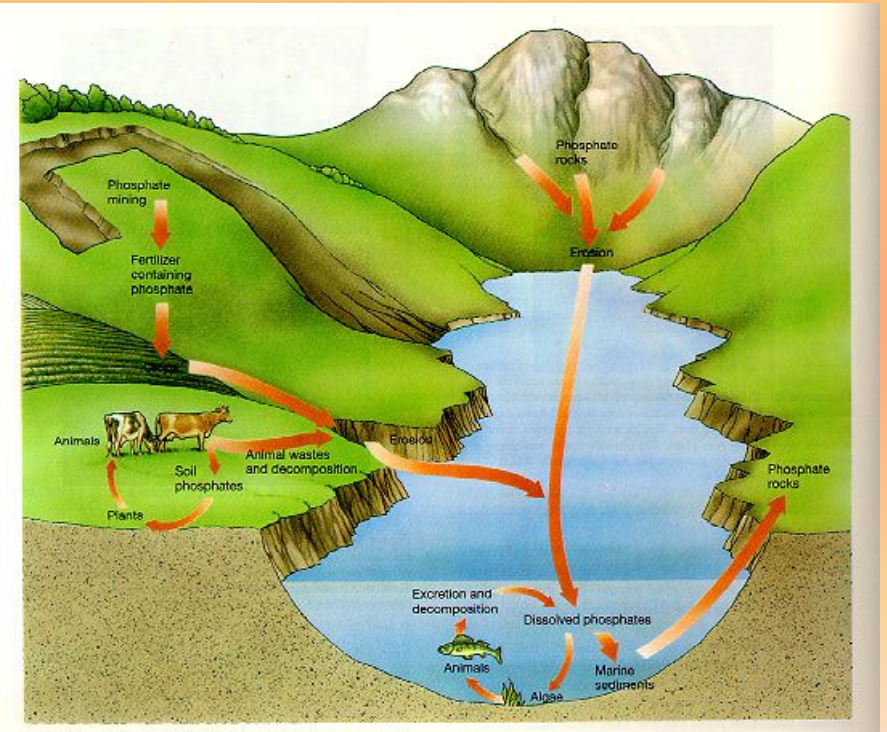
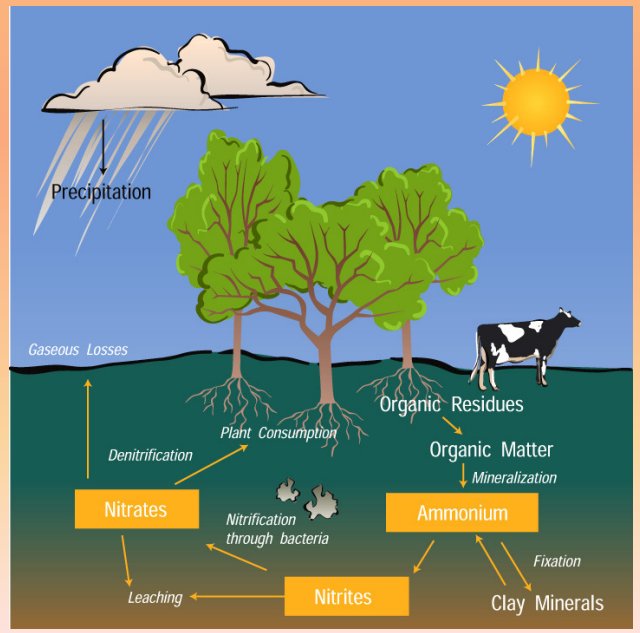


Figure 54–5 The phosphorus cycle in terrestrial and aquatic environments. Recycling of phosphorus (as phosphate, PO_4^{3-}) is slow because no biologically important form of phosphorus is gaseous. Phosphate that becomes part of marine sediments may take millions of years to solidify into rock, uplift as mountains, and erode again to become available to living things.

NITROGEN CYCLE

- Has gas and mineral phase
- Air is 78% N_2
  - But plants can't use nitrogen gas directly
  - ***Nitrogen fixation*** =
    - Bacteria and blue-green algae convert nitrogen gas into more useable form



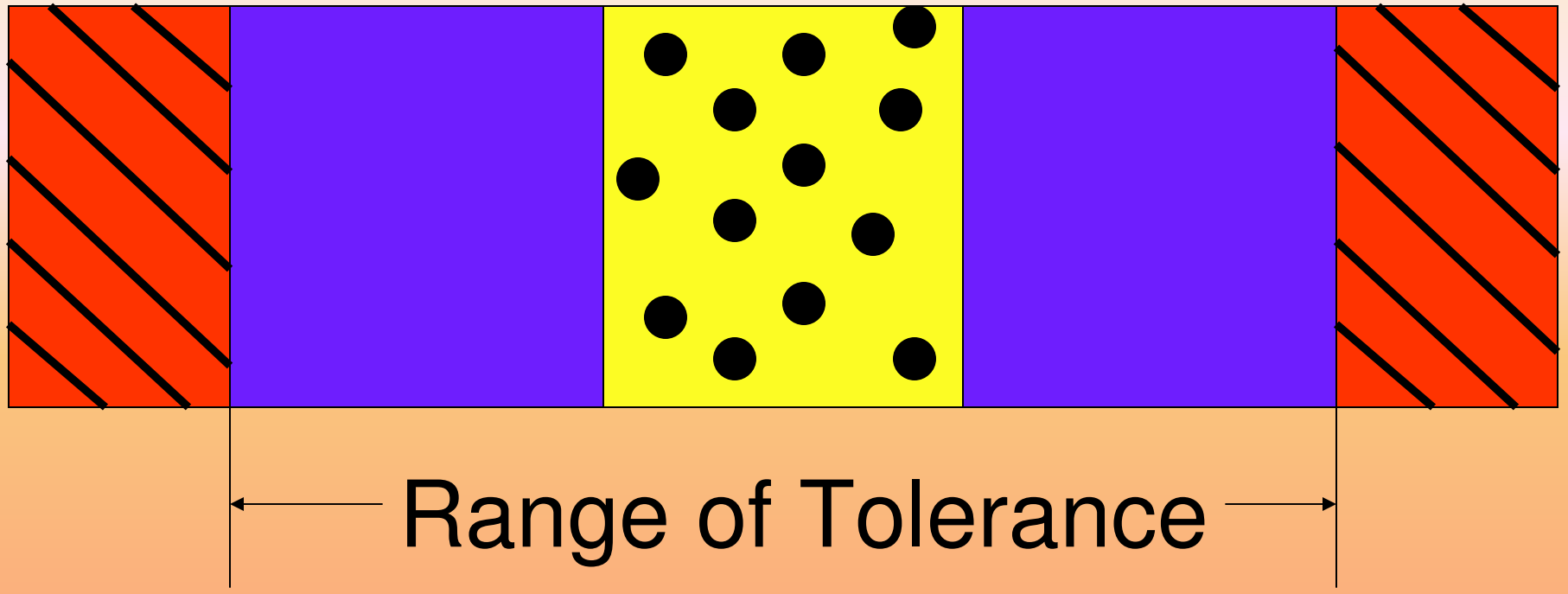
NITROGEN CYCLE

1. Bacteria absorb nitrogen and “fix” it for plants
2. Nitrogen is transferred through food web and released in waste
3. Either
   - Nitrogen is reabsorbed by plants

   OR
   - ***Denitrification*** occurs
     - Other bacteria convert nitrogen back to gas form

BIOTIC AND ABIOTIC INTERACTIONS

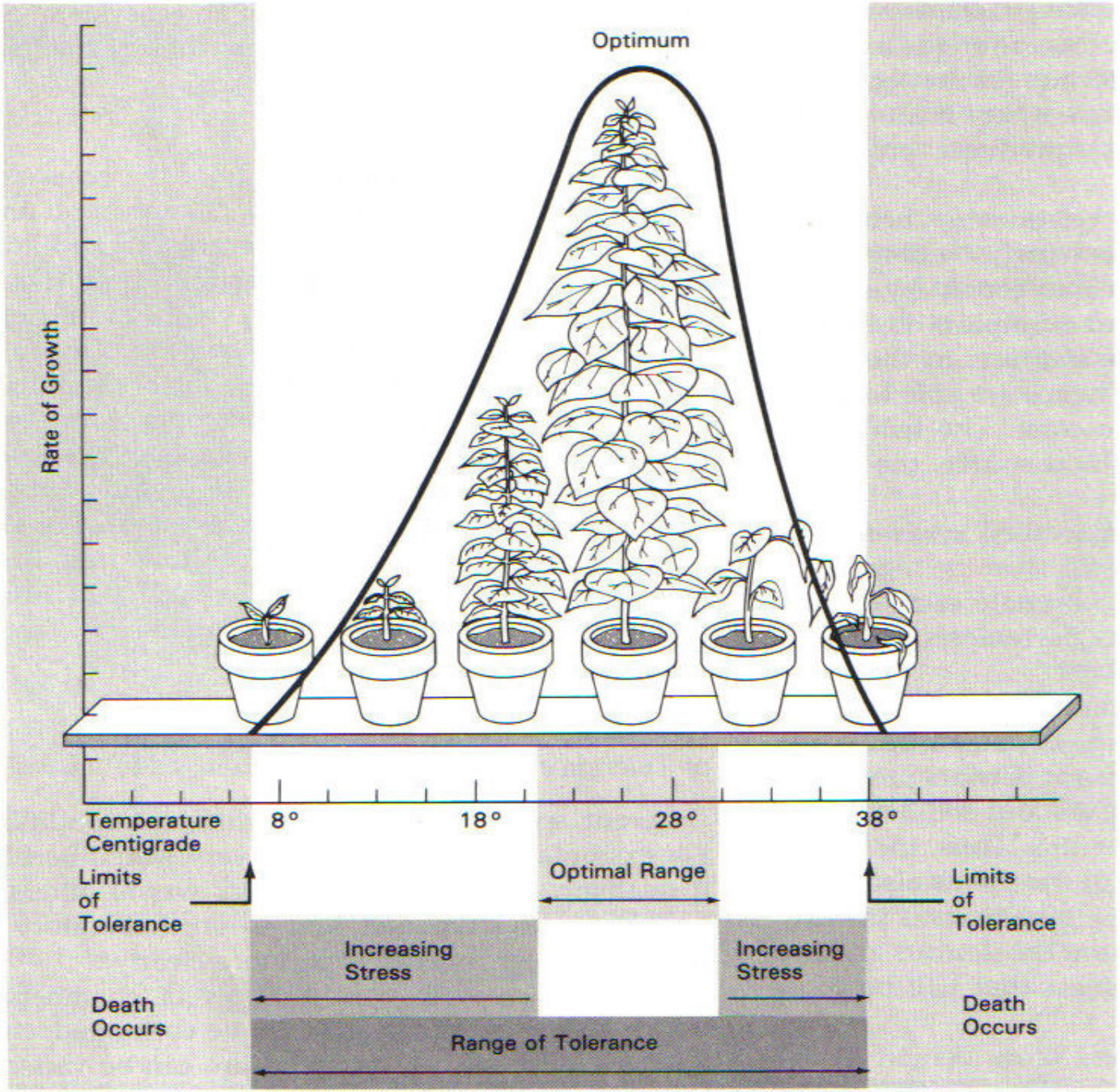
- EACH species (plant and animal) has an optimum, zones of stress, and limits of tolerance for EVERY abiotic factor
- ***Optimum or optimal range*** =
  - Supports maximum growth
- ***Zones of stress*** =
  - Conditions are tolerable but not optimal
- ***Range of tolerance*** =
  - Includes optimal range and zones of stress
  - Supports life
  - Note: Beyond limits of tolerance death occurs!



Optimal Range = Supports maximum growth

Zones of Stress = Conditions are tolerable but not optimal

Beyond Limits of Tolerance = Death Occurs


Optimum
Rate of Growth
Temperature
Centigrade
8°
18°
28°
38°
Limits
of
Tolerance
Optimal Range
Limits
of
Tolerance
Increasing
Stress
Increasing
Stress
Death
Occurs
Death
Occurs
Range of Tolerance

- ***Population Density*** =
  - Number of individuals per unit of area
  - Will be greatest where all conditions are optimal
  - Will decrease but still be present where any factors are in zones of stress
  - Species will not exist where even one factor is outside limits of tolerance!

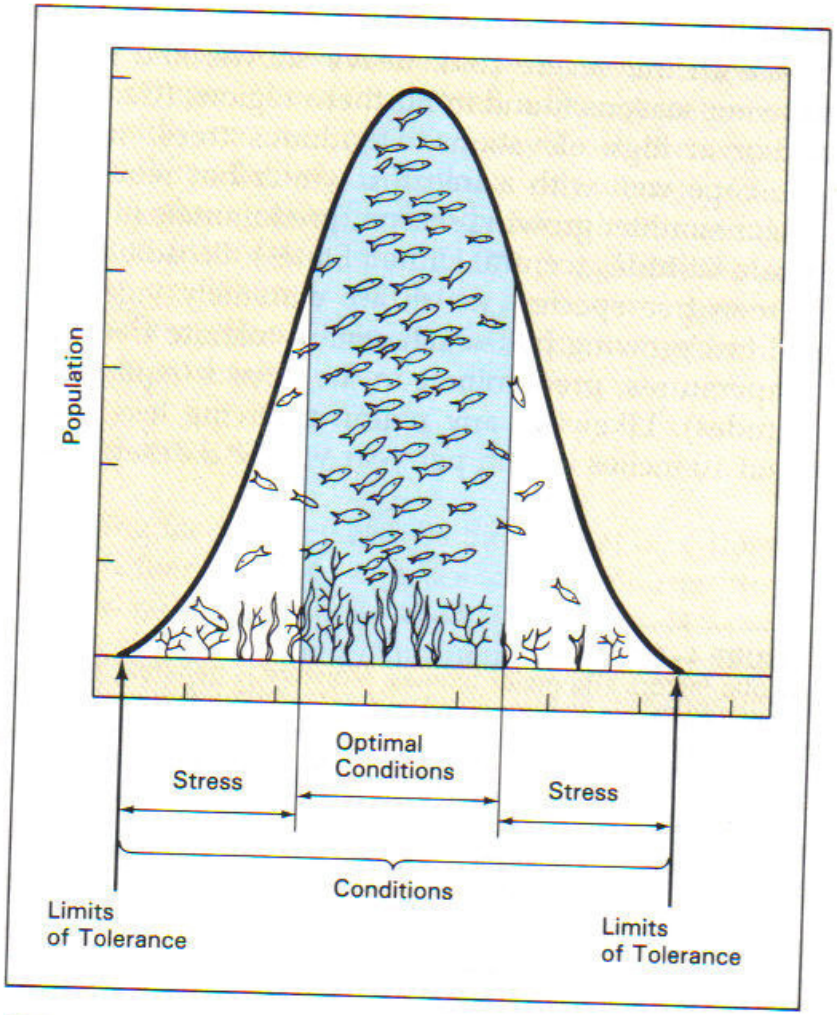


FIGURE 1–17
Individuals will be most abundant where conditions are optimal and less numerous as conditions are less favorable. Individuals will not be found beyond the limits of tolerance.

Population Density

- ***Limiting Factor*** =
  - Factor primarily responsible for limiting growth and/or reproduction of an organism or population

- If any one factor is outside the optimal range, it will cause stress and limit the organism
  - Too much or too little may be a problem

- What is optimum for one species may cause stress or death for another

- NO FACTORS ACT ALONE
- All ecosystems are maintained within certain bounds by limiting factors
- Spread of each species is limited because of competition, tolerance, and physical barriers

SUSTAINABILITY

- ***Critical number*** =
  - Minimum number of individuals required to maintain a healthy population
  - If population falls below, extinction common
  - ***Threatened*** =
    - Species whose populations are declining rapidly
  - ***Endangered*** =
    - Population is near critical number